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affords means for adding any required amount of pressure in the rough grinding process, and thus that tedious part of the operation is considerably accelerated. It is also adapted for figuring lenses of large dimensions, to which it would impart, as well as to specula, surfaces approaching nearly to those of parabolic, or other required geometric curvatures, and with the addition of another mandril, or more, receiving rapid motion from the periphery of the fly-wheel, it has been used with great convenience for grinding and polishing lenses of the smallest dimensions.

On the Construction of a small Observatory, a new Stand for a Transit Instrument, and an Eye-piece for facilitating the Rectification of Instrumental Errors by Reflexion.[*] By John Drew, F.R.A.S.

"A very excellent 5-foot telescope by Dollond, which had been tested by Captain W. H. Smyth, who mentions it with approbation in the *Celestial Cycle*, came into my possession some time since. To use this instrument with advantage I constructed a small observatory, which has answered the purpose so well that I beg to offer a plan of the building for the use of such members of the Astronomical Society as may wish to have a convenient lodgment for moderate sized instruments at a small expense. I have followed, in most respects, the description given by the Rev. W. R. Dawes of his observatory, in vol. vii. No. 10, of the *Monthly Notices*, the principal difference being in the walls, which are formed of $\frac{3}{4}$-inch weather boarding, the planks overlapping about $1\frac{1}{2}$ inch; the roof only is covered with canvass outside the boards. The experience of two winters satisfies me that the structure is weather-proof.

"Before the foundation was laid, the ground was excavated to the depth of 18 inches and filled up with concrete; on this, brickwork is raised 6 inches above the ground. An oaken curb is laid on the brickwork, into which are inserted uprights $2\frac{1}{2}$ inches by 2, and 6 feet in height. These are united at the top to a corresponding curb, and outside of these are nailed the boards forming the walls.

"The observatory consists of two compartments, the equatoreal-room and the transit-room; the former is 9 feet in diameter, in the form of a duodecagon; the roof is nearly circular, and similar to that of Capt. Smyth at Bedford, with shutters opening in the side, increasing from 9 inches to 2 feet 6 inches in width. The lower curb of the roof and the upper curb of the wall are fitted with cast-iron plates, between which are the 3-inch cannon-balls which support the roof and enable it to revolve. The telescope is mounted with a polar axis having the usual adjustments: the right ascension and declination circles are each 15 inches in diameter, and read off,

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[*] Drawings accompanied this paper, and a model of the transit and stand was presented at the same time by Mr. Drew.

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the one to 4 seconds of time, the other to 1 minute of space. The shutters of the transit-room run along the ridge of a sloping roof, which is held together by iron hoops extending across the slit; these admit of being turned round so as not to interfere with distinct vision. The transit-room, which was originally occupied by a small astronomical circle, is 7 feet long by 6 wide. After I had built it, a very excellent 4-foot transit instrument, by Mr. Jones, late of Charing Cross, came into my possession, and a difficulty arose as to the manner of mounting it in so small a space. Some hints from the Rev. R. Sheepshanks enabled me to overcome the difficulty, and to construct a mounting which, while it occupies a small space, is so stable, symmetrical, and convenient, that I beg to present a model of it to the Society for future reference.

"On the concrete I laid a solid foundation of brickwork wrought with cement; embedded in this is a slab of Portland stone, 6 inches thick, 2 feet 4 four inches from north to south, 3 feet 6 inches from east to west. Two blocks are then erected on the east and west sides of this slab, 1 foot thick, and 2 feet 6 inches high; these have an open space of 1 foot 6 inches between them for the observer's legs. Another slab, of the same size and thickness as the first, is laid across these blocks. On the north and south sides of this upper slab two semicircular spaces are hollowed out, to admit of the observer's approach to the eye-piece of the transit instrument when the telescope points near the zenith. From the east and west sides of this upper slab rise the two piers, 1 foot square at the base, each of them bevelled off from the part immediately beneath the axis of the transit to a thickness of 6 inches; on these piers, which are 3 feet high, rest the plates which support the pivots of the axis of the transit instrument. The floor of the room runs over the first slab, and is independent of it; while the second slab, under which rest the legs of the observer when in a sitting posture, serves as a table for recording the observation.

"It is necessary with this mounting to make use of a diagonal eye-piece in taking transits of stars more than 55° in altitude; most of the slow-moving circumpolar stars may, however, be observed with a direct eye-piece.

"The upper slab affords facilities for correcting the adjustments by reflexion from a surface of mercury; for this purpose I use an eye-piece of a very cheap and simple construction, which enables me to arrive at the desired result with ease and precision. The wires of the transit instrument, when it is in a vertical position, are illuminated by a small mirror attached externally to the eye-piece, and moving on a hinge; by this mirror the light is thrown obliquely through an aperture in the side, and the wires illuminated; the direct and reflected images will then appear by looking down into the mercury through the telescope.

"The Beaufoy Clock, of which the Society has obligingly allowed me the use, stands on a pier in the transit-room.

"The cost of the observatory, exclusive of the instruments and their mounting, was 50*l*.

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"The latitude and longitude of my station, as determined by triangulation from the Ordnance Map Office, Southampton, are as follows:—

Latitude	50° 54′ 34″	North.
Longitude	1 24 25·8	West.

Mr. Edward Cowper, professor of manufacturing art and engineering in King's College, University of London, presented a model with a description of an equatoreal mounting for a telescope. The peculiarity is in the polar axis. He proposes to make this a cast-iron pillar of great length and substance, resting with its lower end, which is continued a good way below the floor, in a socket, and having its upper support a little above the floor on a stone pier, through which the pillar is carried. The adjustments of the axis are made at this upper support, and above this there is a considerable length of axis quite clear.

A thimble or cap of a conical form goes over the polar axis, and is fitted to it at the top, and again a little above the floor. On the upper end of the cap the declination axis is fixed, just as in the German mounting. This cap carries the lower circle at its base, and is so long that there is comfortable room for the telescope and the head of the observer above the pier.

Mr. Cowper remarks, "that in this arrangement the telescope can pass the meridian in any position; the telescope can be directed to the pole without any impediment; the circles may be of large dimensions, and the polar axis being long, the motion is true. By treating the whole as a piece of *engineering* work, making everything as solid and strong as an engineer would do in making a crane to carry 20 tons or a 25-foot jib, the necessary stability would be easily attained."

Besides presenting a model, Mr. Cowper has sent a drawing with his description, so that there can be no difficulty in understanding the whole of the contrivance.

Mr. Dale presented the model of an instrument intended to be a substitute for the sliding rule.

This consists of one or more logarithmic spirals carefully drawn on a smooth plane, and a jointed rule resembling in form the usual sector in the case of mathematical instruments.

The fundamental property of the logarithmic spiral is, that all sectors having the same angle between the radii vectores are, in every respect, similar.

In Mr. Dale's drawing, the radius vector is supposed to increase tenfold in one revolution. The jointed rule is graduated on the inner edges to equal parts, reckoned from the centre; and the centre, on which the two parts of the rule turn, is fitted by a pin exactly upon the centre of the spiral.

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To find a fourth proportional:—1st, Turn the rule round until that division of the scale on the first leg, which expresses the first term, is cut by the spiral; hold this in its place, and turn the other leg round the joint of the rule till it is also cut at the second term by the spiral. Now, carefully keeping the rule at this opening, turn the whole round till the third term on the first leg is cut by the spiral. The fourth or required term will be that division on the round leg which is cut by the spiral.

To find the square of any number, the first leg must be set to 1, and the second to the number whose square is required. If the rule be now turned through this angle, the second leg will show the square.

If a divided circle be drawn concentric with the spiral, then the square, cube, *n*th root may be found by placing the legs at one-half, one-third, one-*n*th of the angular opening between 1 and the number whose root is required.

Also, by dividing other concentric circles so that the first leg remaining at 1 or 10, the other leg cuts the spiral at the value of various functions of the arcs, it is easy to introduce trigonometrical and other functions.

Mr. Dale shows how, by using a second spiral on a different scale, the same instrument may be made to apply to a greater extent.

If this instrument should be found useful, it would probably be necessary to adopt some contrivance for preserving the angle between the legs of the rule while the whole scale is turned about.

" The spiral may be laid off by drawing radii and marking off the lengths from a table of logarithms. It can, however, be described by continuous motion: for if a wheel have a female screw cut through its axis, and this be screwed upon a radius having on it a male screw, then, on turning round the radius, the track of the wheel is a logarithmic spiral."

Mr. Rümker has sent a copy of all the observations of the moon and culminating stars which have been observed at Hamburg in the years 1848, 1849. These will be carefully preserved for reference and consultation.

ERRATUM.

Vol. x., No. 2, p. 40, *for* Leary not mounted *read* Carey not inverted.

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